Docket No. 243.2

TITLE: **WELLHEAD LEAK CONTAINMENT AND BLOWOUT DEFLECTION APPARATUS**

FIELD OF THE INVENTION

The present invention relates to servicing equipment for oil wells generally, and in particular relates to a means of containing fluids, such as oil and salt water, leaking from a wellhead, and storing such fluids for further use.

BACKGROUND OF THE INVENTION

An environmental and economic problem at oil and gas wellsites is the leakage of oil and/or other produced fluids, such as salt water and related oil by-products. Typically, the seals in a suffing box of a wellhead pumped by a pumpjack wear out over time and begin to leak oil down the wellhead and into the surrounding soil before the leak is detected and new seals are installed. This pattern may repeat itself many times over the life of a wellsite, resulting in contamination of the wellsite with oil and produced fluids. Such contamination can result in water table damage and may spread to residential water wells and the like. Reclamation costs of such wellsites are time consuming and expensive. Some earlier attempts have been made to address such leaks, but have failed, partly because, until recently, the scope of the problem has either not been know or not taken very seriously.

Some of the earlier attempted solutions to the problem have failed because of ineffective sealing at the lower flange of the stuffing box, thus allowing the oil and/or produced fluid to leak out of the fluid containment device along the wellhead piping onto the surrounding soil. Other products have not been adopted as they require disruption of the oilwell operation for their installation, and some even require modification to the stuffing box and/or wellhead piping and components. Another drawback is that such prior products require considerable time (one or more hours) and tooling for installation.

What is therefore desired is a product that overcomes these disadvantages and problems.

SUMMARY OF THE PRESENT INVENTION

According to the present invention, there is provided in one aspect an apparatus for containing fluids, such as oil and salt water leaking from a wellhead, and storing such fluids for re-use or disposal. The apparatus should be capable of quick installation without interfering with wellhead operation, and should require few if any tools.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is a side view, partially broken away, of a containment apparatus according to a preferred embodiment of the present invention mounted on a stuffing box of a wellhead for capturing any fluids leaking from the stuffing box, and for chanelling and storing the leaked fluids for further use;

Figure 2 is a top perspective view of a base portion of the containment apparatus of fig.1;

Figure 3 is a top plan view of the base of fig.2;

Figure 4 is a cross-sectional view of the base along line 4-4 of fig.3;

Figure 5 is a cross-sectional view of a drain hole portion of the base along a line 5-5 of fig.3;

Figure 6 shows a gasket for placing along a split section of the base of fig.1;

Figure 7 is a bottom perspective view of a an alternate embodiment of the containment apparatus of fig.1 showing an adaptor ring for mounting the base to a different sized stuffing box;

Figure 8 is a top plan view of a cover portion of the containment apparatus;

Figure 9 is an elevated side view of the cover of fig.8;

Figure 10 is a cross-sectional view of the cover along line 10-10 of fig.9;

Figure 10a is a perspective view of a split slinger disk for mounting onto a sucker rod beneath the cover;

Figure 11 is an elevated view of an alternate embodiment of a cover of the containment apparatus; and,

Figure 12 is a side view of the alternate embodiment of the cover viewed in the direction of arrow 12 in fig.11.

LIST OF REFERENCE NUMBERS IN DRAWINGS

20	wellhead
22	sucker rod
24	stuffing box
26	flange of 24
30	containment apparatus
40	base of 30
42	sidewall
43	lip of 42
44	top end (open)
46	bottom end (open)
48	upturned lip
50	reservoir
52	tabs
53	buckle for 30
54	split of 40
56	flange of 40
58	gasket
60	flange(s) of 58
62	web of 58

64 drain

66 hose

68 collection tank

70 lid

72 lower lip

73 lower opening of 70

74 flange of 70

76 apertures in 74

78 wing nuts

79 hinge pin and lanyard arrangement

80 opening in top of 70

82 split disc

84 extended top of alternate embodiment of lid

90 adaptor assembly

92 split adaptor disk

94 seal and hose clamp

DESCRIPTION OF PREFERRED EMBODIMENTS

The figures show an apparatus (generally designated by reference numeral 30) for containing fluid leaks from a wellhead 20. A pumpjack typically moves, or lifts, a vertically oriented polished rod 22 up and down in the wellhead to pump underground fluids to surface. The polished rod passes through a stuffing box 24 at the upper end of the wellhead which is meant to seal the wellbore from the ambient. However, as the seals in the stuffing box wear out, fluids often penetrate the seals and escape onto the ground surrounding the wellhead. Hence, the present apparatus 30 is mounted aboveground around the wellhead's stuffing box 24 and where such leaks often occur. The leaking "fluids" referred to herein are most commonly crude oil and salt water, and can include any other liquids toxic to the surrounding environment.

The wellhead apparatus 30, referred to herein soemtimes as a SKIRT™, is principally composed of a base 40 and a two-piece cover 70. Referring first to the base 40, and figures 1-6, a vertically oriented circumferential sidewall 42 forms a basin with an open first, or top, end 44 and an open bottom end 46. The opposed second, or bottom, end has an upturned lip 48 forming a circumferential reservoir 50 below the bottom opening 46 for capturing leaking fluids. The reservoir is an important feature in that it forms a means of capturing the leaking fluid away from the opening 46 to reduce the chances of escape therethrough. Rather, the reservoir's floor has a drain 64 (good results have been had with a drain opening of 2 inch nominal diameter) for draining the fluid

from the reservoir through a detachable flexible hose 66 to a grounded heavy-duty fluid collection tank 68 from which the fluid may be recovered periodically for further use or disposal.

Several integral tabs 52 extending radially inwardly from the upper edge of the lip 48 are adapted to engage a bottom flange 26 of the common single or multi-staged stuffing box, and thus serve to support the base on the wellhead. The base is split at 54 to allow quick mounting of the base onto the wellhead without disruption of pump jack operation. Hence the material forming the base, such as a plastic, should be flexible enough to allow the base to be pried open sufficiently to pass over the polished rod and other components above the stuffing box. Each side of the split area 54 has opposed inwardly extending flanges 56 to avoid fluidleakage out of the reservoir 50 through the split 54.

A compressible rubber or neoprene gasket 58 (see fig.6) is provided to fluidly seal the base and the flange beneath the stuffing box. The gasket 58 is contoured to generally reflect the cross-sectional shape of the base (as viewed in fig.4). Each gasket flange 60 is shaped to mate with a respective base flange 56 to prevent fluid leakage out of the base 40 through the split 54, and the gasket's web 62 is adapted to follow the perimeter of the upturned lip 48 and to engage the flange of the stuffing box to fluidly seal the base about the stuffing box. Once the base 40 and the gasket 58 are properly located about the

stuffing box, a lockable latching buckle 53 tightens, or "closes", the base and gasket to the stuffing box's flange in a friction fit.

As the size of stuffing boxes is not uniform, the base's bottom opening 46 may be too large for certain boxes. Hence, an adaptor assembly 90 (shown in fig.7) is provided to secure the base 40 beneath the stuffing box. The assembly includes a donut-shaped split adaptor disk 92 (resembling the shape of the split slinger disk shown in fig.10a) made of a suitable flexible and resilient material which may be pried open and slipped onto the piping below the stuffing box. The disk 92 should be secured immediately below the stuffing box, such as with a circumferential seal and hose clamp 94 (or like arrangement). The outer diameter of the disk is sized so that the base's tabs 52 rest thereon, thereby supporting the base about the stuffing box. The mounting of the adaptor assembly may therefore be achieved without interfering with the well's operation.

The base 30 is capped by a detachable two-piece cover or lid 70. One half of the lid is shown in figs. 7-10, and the other half which abuts the one shown is in essence a mirror image of the one shown. The lid is split in two so that it may be mounted about the stuffing box and sucker rod without disrupting wellhead operation. The lid has an outwardly and downwardly flared circumferential lip 72 forming a first, or lower, opening 73. The perimeter of the lip is shaped to mate atop the outwardly and upwardly flared lip 43 of the base 40. The transverse edge 74 of each lid portion is formed by a flange with several spaced apertures 76 for bolting the cover sections together, preferrably by hand

without tools, such as with finger-operated wing nuts 78 (fig.7). The assembled cover is in turn securedto the base 40, such as with two or more hinge pin and lanyard arrangements 79 (fig.7). The upper and lower lips 72, 43 are adapted to mate in fluid sealing manner, namely any fluid that might impact the domed inside surface of the lid progresses down the inside surface and flows across the cover/base interface toward the base's reservoir 50 rather than escaping to the ambient.

The dome of the cover has a second, upper opening 80 sized for fitting about the sucker rod 22, and a split slinger disc 82 (shown in fig.10a) made of high density polyethelene is fitted about the sucker rod 22. The lid surrounds and covers the stuffing box body to function as a blow-out deflector and weather protector. In the event of a blow-out the disc 82 is forced to slide upwardly along the rod to seal the opening 80, and so fluids escaping as a result of the blow-out deflects off the lid and settles in the base, thus being contained by apparatus 30.

The operation and many advantages and features of the present invention may now be better understood and summarized.

Good results have been achieved for the base and lid construction using flexible lightweight plastic materials adapted for either standard (i.e. down to -50 C ambient) or high temperature (up to 122 C) applications. The standard temperature wellhead Skirt design allows for installation on conventional oil pumping operations, whereas the high

temperature wellhead Skirt design allows for installation on high temperature heavy oil pumping operations.

The present containment apparatus 30 installs easily and quickly about a stuffing box and can be installed without shutting down pumping operation.

No special tools are required, thus facilitating Skirt installation.

The Skirt does not utilize replaceable absorbent materials. Any leakage is drained through a the drain hole 64 in the base into the large grounded heavy-duty fluid collection tank. This allows for recycling of leaked fluid back to the battery and prevents any ground contamination due to a packing blowout. Prior art devices are not adapted to contain excessive leakage.

The base 40 has four integrated mounting tabs 52 and a compressible rubber or neoprene gasket 58 for quick and convenient support on the lower flange of the stuffing box (or on the adaptor assembly 90). Further, the base 40 is split, allowing for installation without disruptions in wellhead operations.

The Skirt is closed and secured to the stuffing box with the lockable latching buckle 53 located on the outer face of the base. When latched, the split in the base is sealed with the compressible rubber or neoprene gasket 58 located below the four integrated tabs 52.

The two sections of the lid 70 fit over the base 40 and bolt together via six hand tightened wing nuts, thus allowing for ease of installation without interruptions in pumping operations.

The lid is secured to the base by two locking pin and lanyard arrangements located opposite to each other on each half of the lid. The lid sections are placed over the base and the pins are placed through aligned pre-drilled holes in the lid and base to secure the lid to the base. Such arrangement provides ease of access to the stuffing box for wellhead maintenance.

Once the base 40 is installed on the wellhead, it need not be removed for maintenance of the stuffing box since removal of the lid provides sufficient unobstructed access to the stuffing box.

The completely assembled containment apparatus 30 also functions as a blowout deflector to further reduce the risk of ground and water contamination by escaping fluids.

The Skirt protects the stuffing box seals from damage by snow, wind and sand.

The Skirt controls against wellhead freeze up and wax problems, and helps deter wellhead surface casing rust and corrosion.

The Skirt reduces or eliminates ground and water contamination from the stuffing box, thus reducing costly land reclamation and well abandonment costs due to excessive wellhead leakage.

The Skirt reduces costly wellhead steam cleaning.

The reservoir 50 avoids leakage of fluid from the base around the rod or through the base's bottom opening 46.

In one variation of the lid, an elongated or extended top portion 84 (see figs. 11 and 12) is provided to fit over and surround a pollution box flapper valve used above the stuffing box.

In yet another variation of the present invention one or both halves of the lid may be constructed of a clear UV protected plexi-glass material to allow the operator a convenient, unobstructed view into the base.

Installation of the Skirt requires no expensive modifications to the wellhead, moving of equipment, valves, or removal of the Presco (line pressure) switch.

The Skirt may be used on all types of rod pump oil wells, including wells with Rodaflex™ pumping units, and allows for installation and use of polish rod lubricators.

The above description is intended in an illustrative rather than a restrictive sense, and variations to the specific configurations described may be apparent to skilled persons in adapting the present invention to other specific applications. Such variations are intended to form part of the present invention insofar as they are within the spirit and scope of the claims below.